Knowledge Discovery from Texts on Agriculture Domain

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Knowledge Discovery from Texts on Agriculture Domain

Outline

Part 1 Data Science and Big Data

Part 2 Heterogeneity and textual data

Part 3 Applications in agriculture domain

Part 4 Conclusions and future work

Part 1

Data Science and Big Data

Big Data

Volume

Velocity

Variety

3V of Big Data

Variability, Véracity, Value,

Visualisation, Valorization

Part 1

Part 2

Heterogeneity and textual data

Introduction

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Heterogeneity of types of documents

Textual data and satellite images

[Roche *et al.* SI'2014]

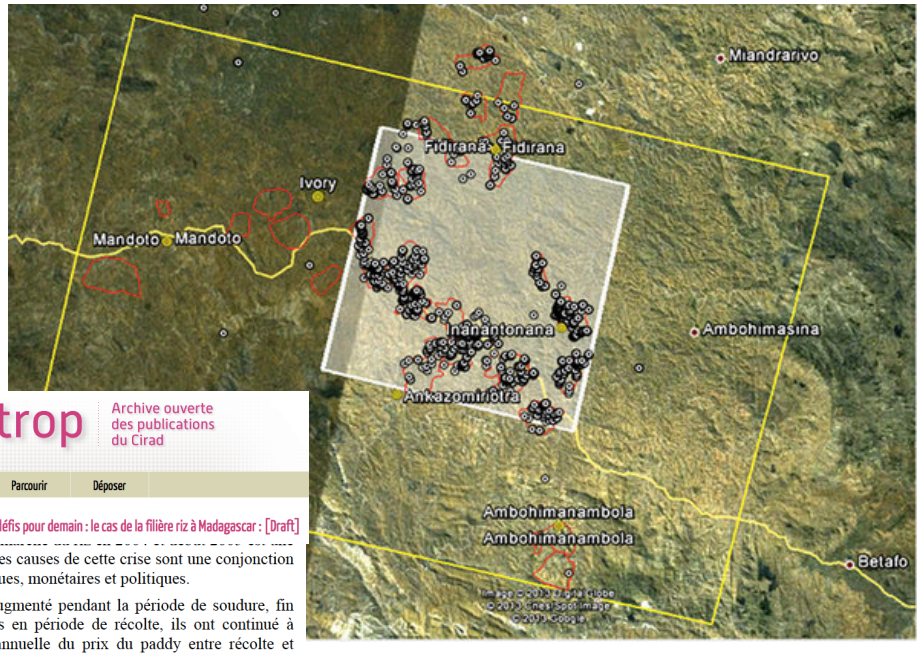
Vakinankaratra – L'agriculture de conservation lancée

17.12.2014 | 7:18 | Non classé | 0

L'agro-écologie est une nécessité. Plus de 80% de la population malgache vit en milieu rural et opère en général dans l'agriculture. La croissance démographique associée au changement climatique provoque une forte destruction de l'environnement et une dégradation alarmante de la fertilité des sols. Afin d'y faire face et pour mieux lutter contre la malnutrition, le Groupement semis direct de Madagascar lance le projet Manitatra dans quatre communes rurales du district de Betafo et de Mandoto, dans la région Vakinankaratra. Ce projet est réalisé en partenariat avec le ministère de l'Agriculture et du développement rural et sur financement de l'Association française du développement et du Comesa.

Le groupement qui focalise son activité sur l'agro-écologie et l'agriculture de conservation, sensibilise et incite les paysans des communes ciblées à pratiquer l'agriculture sous couverture végétale et la rotation culturale. Et afin d'assurer une sécurité alimentaire da la commue rurale d'Ankazomiriotra, d'Inanantonana, de Vinany et de Fidirana, le projet Manitatra compte adhérer 1000 paysans, dont 200 femmes, sur la pratique de ce système de culture agro-écologique qui ne nécessite pas des nombreux travaux et éreintant comme l'exige le labourage. « Il suffit que les paysans recouvrent le sol de végétaux et cultivent sans dépenser du temps et de l'argent pour l'achat d'outils », no Rakotondramanana, directeur exécutif du projet qui s'active aussi dans le Sud-Est de Des formations sur la régénération de la fertilité du sol et la lutte contre sa dégradatio ainsi que l'introduction du système des légumineuses seront la priorité des activités d projet.

Angola Ny Avo



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Crise hier, opportunités aujourd'hui, défis pour demain : le cas de la filière riz à Madagascar : [Draft]

augmentation sans précédent des prix de détail. Les causes de cette crise sont une conjonction de plusieurs facteurs, internes et externes ; physiques, monétaires et politiques.

L'an dernier, les prix du riz ont normalement augmenté pendant la période de soudure, fin 2003 début 2004, mais ne sont pas redescendus en période de récolte, ils ont continué à augmenter à un rythme soutenu. La variation annuelle du prix du paddy entre récolte et soudure est habituellement de l'ordre de 50% au Lac Alaotra, elle a été de 150% en 2004-2005 [Minten et Ralison, 2005]. Le prix du riz national ou importé dépassait historiquement 1000 Ar le kg entre septembre 2004 et février 2005 sur les marchés de la capitale. Si on compare l'évolution des prix du riz en 2001 et en 2004, on peut se rendre compte que les trois premiers mois de l'année il coûtait moins cher en 2004 qu'en 2001 et 2,5 fois plus cher en novembre.

Cette hausse des prix s'est généralisée dans tout le pays. Elle s'est répercutée dans l'espace : marchés urbains et ruraux, auprès de tous les agents de la filière et pour toutes les variétés de riz (vary gazy, makalioka, tsipala, riz pluvial…). A titre d'exemple, dans le Moyen-Ouest, la hausse des prix du riz a été aussi importante sur les marchés situés en bord de route nationale que sur les marchés plus enclavés comme Inanantonana (45 mn de piste en saison sèche), Vasiana (1h15mn), Mahasolo (2h30mn) ou Ambalanirana (4h).

How to match documents?

- **Data and Issue**

- Hard Disc (157 188 files)

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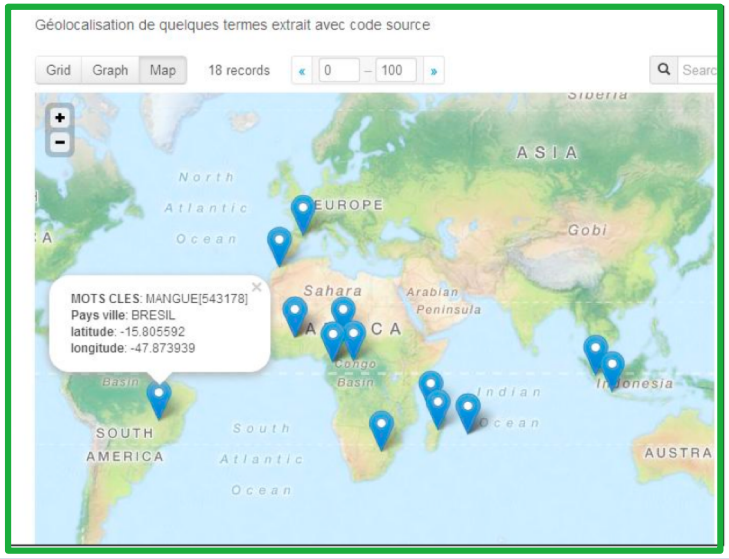
UNIVERSITÉ CONSTANTINE 2

How to match documents?

- **Method: Extraction of features** [Roche *et al.* CA'2015]

3 types of features:
- thematic features
- spatial entities
- temporal entities



17.12.2014 | 7:18 | Non classé | 0

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How to match documents?

- **(a) Extraction of features: thematic terms** [Lossio Ventura *et al.* ISWC'2014]

How to match documents?

- **(a) Extraction of features: spatial features (SF)**

Model

- **Global Model**: SF is composed of at least one Named Entity (NE) and one variable number of spatial indicators specifying its location. SF can then be identified in two ways:

- **Absolute spatial feature** (A_SF) one NE with a geo-localization, such as <(spatialIndicator)*, NE of Location> (ex: *the city of Constantine*).

- **Relative spatial feature** (R_SF) one spatial with at least one SF (ex*: in the south of the city of Constantine*).
  An R_SF is defined as <(spatial relation)$^{1..*}$, A_SF> or <(spatial relation) $^{1..*}$, R_SF>
  Five spatial relation types are considered: orientation, distance, adjacency, inclusion, and geometric which defines union or intersection linking two SFs.

How to match documents?

- **(a) Extraction of features: spatial features (SF)**

Methods [Kergosien *et al.*, IJGIS'2014]

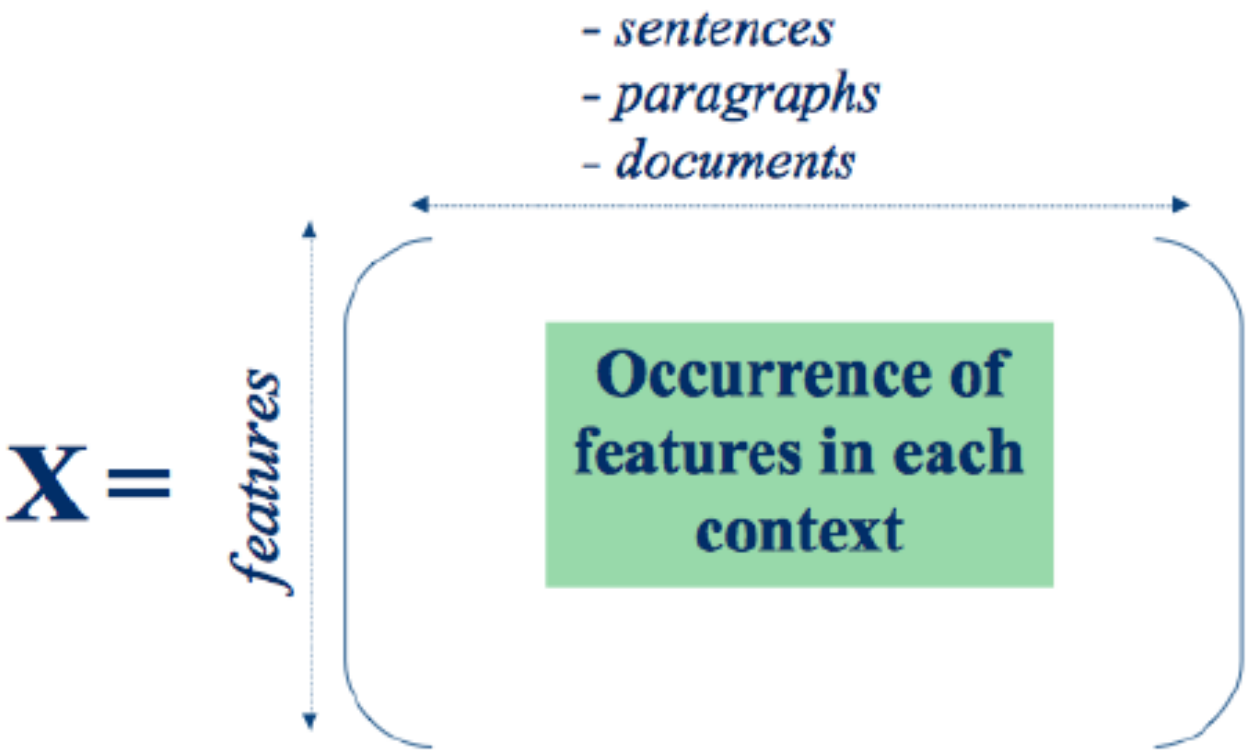
- **Symbolic approach:** Using rules (*Text2Geo*) for extracting A_SF and R_SF

Basic patterns			Text2Geo paterns			
	A_SF	R_SF		R_SF	R_SF	OE
Precision	20%	**48%**	Precision	53%	84%	**92%**
Recall	**63%**	27%	Recall	**94%**	66%	35%
F-mesure	30%	**34%**	F-mesure	67%	**74%**	50%

- **Statistic approach:** Using context and IR methods for spatial features disambiguation

How to match documents?

- **(b) Representation of documents**



How to match documents?

- **(c) Similarity**

$$Global\_Sim(vect1, vect2) = \alpha.cosT(vect1, vect2) + (1-\alpha).cosS(vect1, vect2)$$

with $\alpha \in [0,1]$

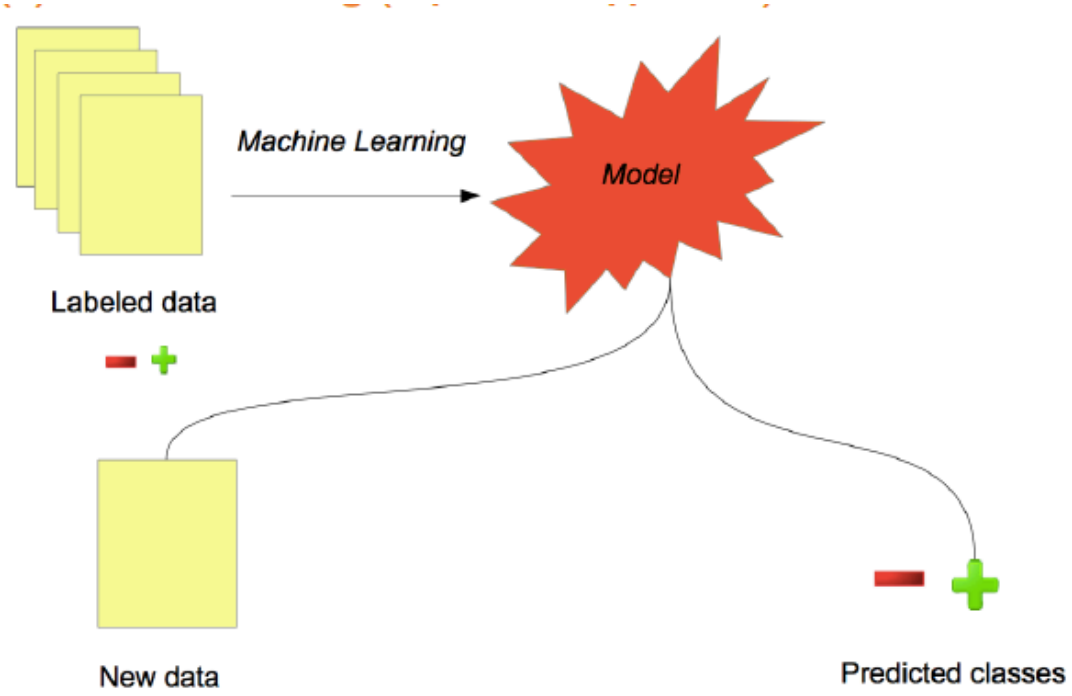
cosT: cosine based on **thematic features** (BioTex)
cosS: cosine based on **spatial features**

Perspective: adding temporal information

How to match documents?

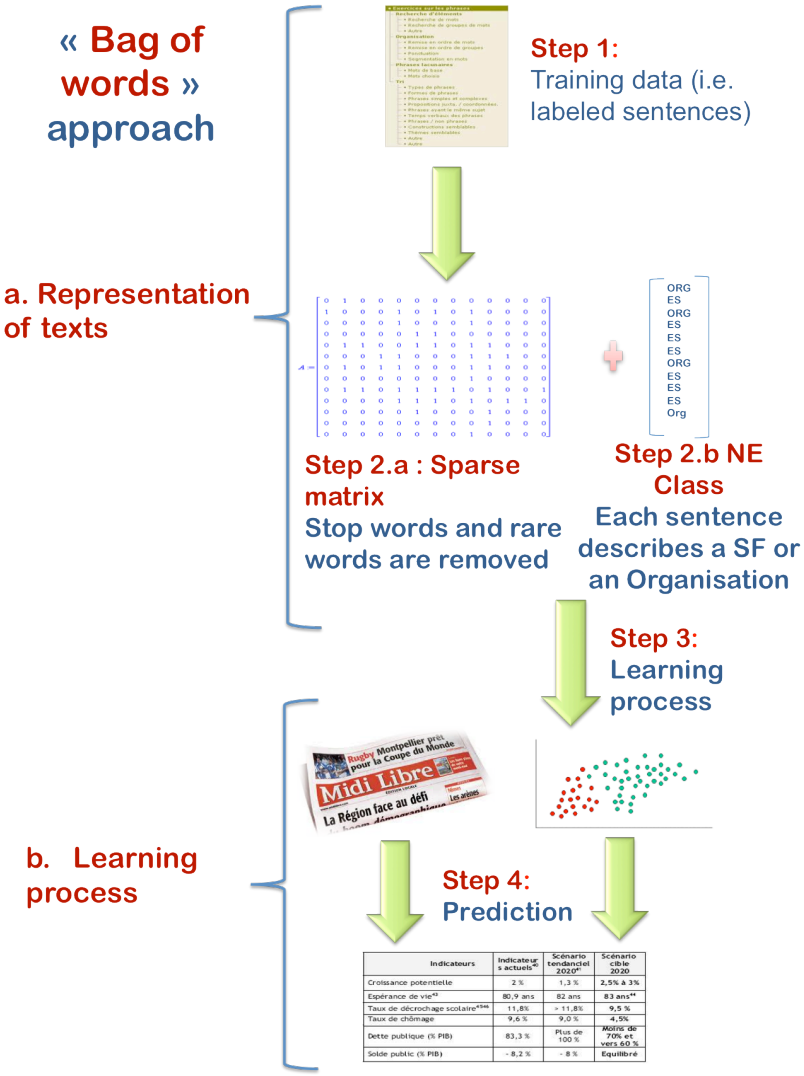
- **Extension:** How to analyse document with more precision?

Example: Disambiguation between **location** and **organisation** [Tahrat *et al.* WIMS'2013]



How to match documents?

- **Disambiguation** between **location** and **organisation**



How to match documents?

- **Disambiguation** between **location** and **organisation**

SVM		SF	OE
	SF	103	35
	OE	44	90
Accuracy	*70.96%*		

Naive Bayes		SF	OE
	SF	98	40
	OE	44	90
Accuracy	*69.12%*		

Features with ConceptOrg		SF	OE
	SF	108	30
	OE	47	87
Accuracy	*71.69%*		

Features with ConceptSpa		SF	OE
	SF	112	26
	OE	19	115
Accuracy	*83.45%*		

Both types of features		SF	OE
	SF	113	25
	OE	19	115
Accuracy	*83.82%*		

Part 3

Applications in agricultural domain

Animal disease surveillance

In collaboration with **CMAEE** lab
(Control of exotic and emerging animal diseases)

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Why the need of Epidemic Intelligence? (1/3)

More than **60% of the initial outbreak reports** come from unofficial informal and **heterogeneous sources**, including sources other than the electronic media, which **require verification** [Arsevska *et al.* ISVEE'2015]

INTERNATIONAL BUSINESS TIMES

MONDAY, JUNE 01, 2015 AS OF 2:24 PM CDT

Home | Politics | Economy | Markets / Finance | Companies | Technology

TECHNOLOGY | SCIENCE

Unknown Disease Kills Kazakhstan's Rare Saiga Antelopes, Scientists Baffled

By Kukil Bora @KukilBora on May 30 2015 7:21 AM EDT

News

African Swine Fever in Three Lithuanian Wild Boar

18 May 2015

LITHUANIA - Three wild boar found at two locations were confirmed with African swine fever last week.

OIE

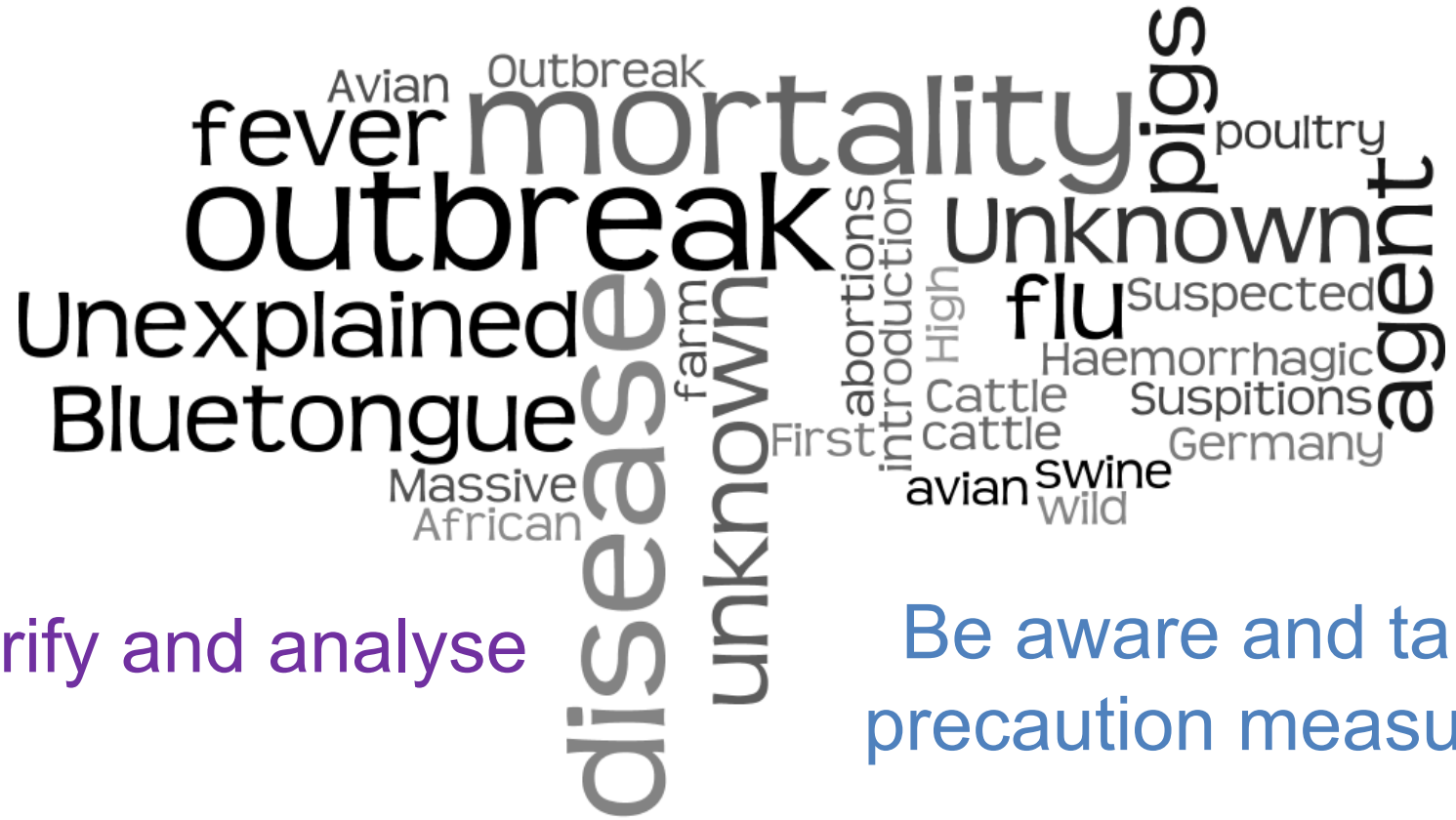
Mysterious disease kills Nigerian patients within a day

The unknown disease has so far killed 17 people in a southeastern Nigerian town and officials have ruled out Ebola.

18 Apr 2015 21:32 GMT | Health, Nigeria, Africa

Why the need of Epidemic Intelligence? (3/3)

Identify signals of new and exotic animal diseases



Verify and analyse

Be aware and take precaution measures

How to detect disease outbreak on the Web?

- **Four animal disease models**: African swine fever (ASF), Foot-and-mouth disease (FMD), Bluetongue (BTV), and Schmallenberg virus (SBV)
- **First model to study**: ASF

Industries | Wed Jul 23, 2014 9:54am EDT

Related: NON-CYCLICAL CONSUMER GOODS

Poland investigates suspected case of African swine fever in farm pigs

WARSAW, JULY 23

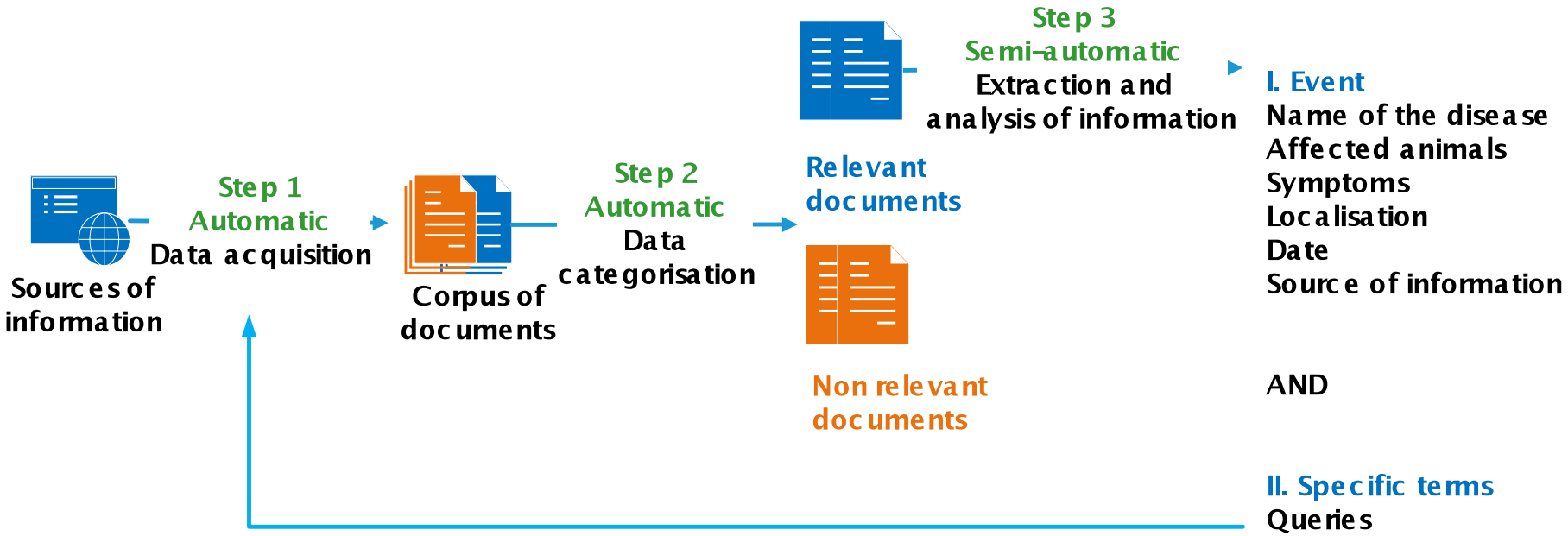
Polish local authorities said on Wednesday that preliminary tests have pointed to a case of African swine fever (ASF) among farm pigs in eastern Poland near the city of Bialystok.

The head of the Grodek county, Wieslaw Kulesza, told Reuters that preliminary results of tests showed that ASF was the cause of death of two-three farm pigs in the county.

"We are marking the area," Kulesza said, adding that further steps, such at laying special mats, were being taken.

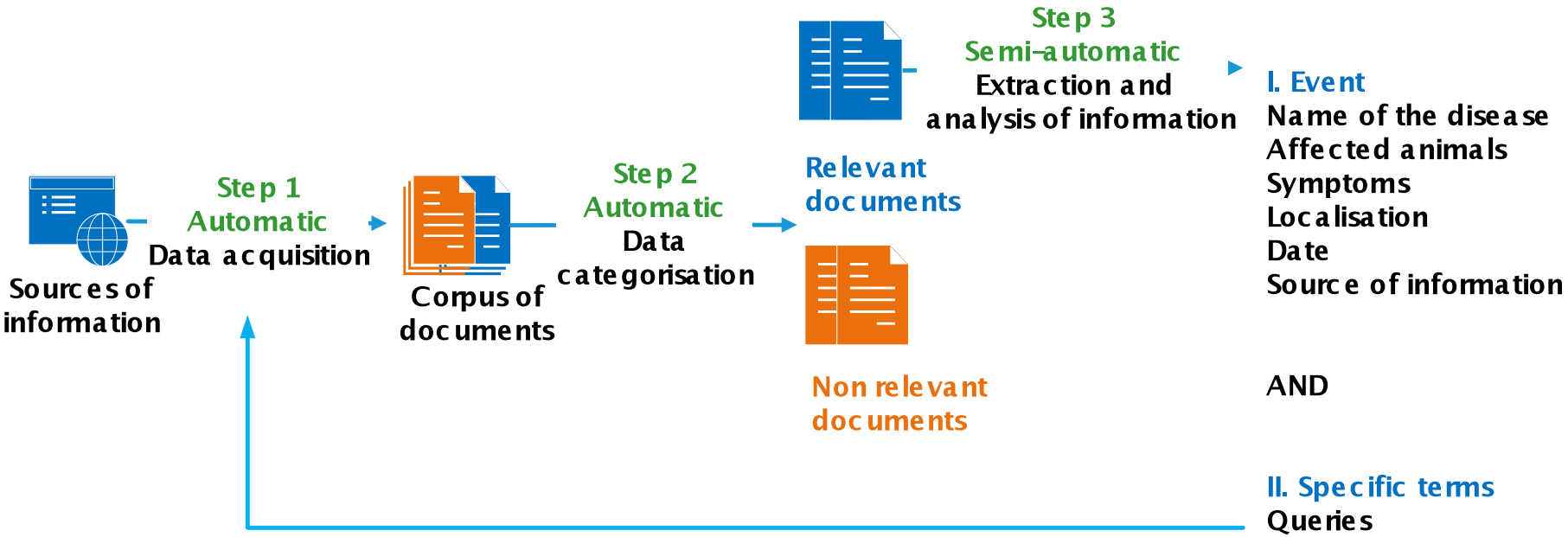
Poland's chief veterinary officer was unavailable for comment, while the county veterinary officer said a statement on the issue will be published later on Wednesday. (Reporting by Anna Wlodarczak-Semczuk; Writing by Marcin Goettig)

Methodology



Methodology - *step 1*

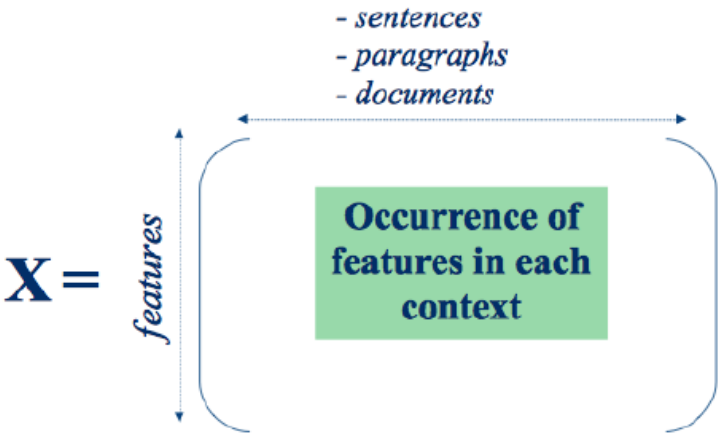
- **Step 1: Data acquisition**

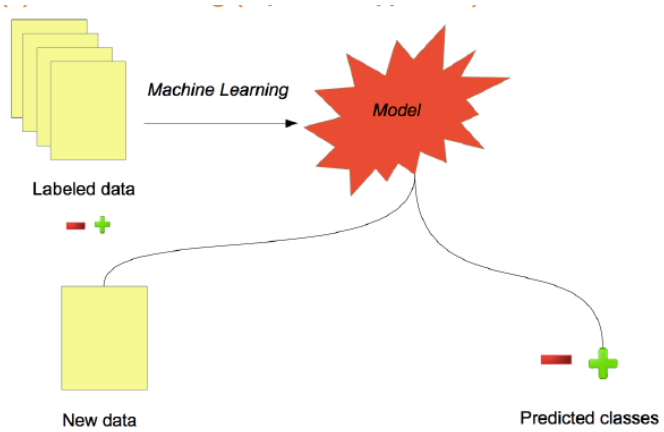


*https://news.google.com/news/feeds?pz=1&cf=all&ned=en&q=**Blue+tongue**&output=**rss***

Methodology - *step 2*

- **Step 2: Data classification**

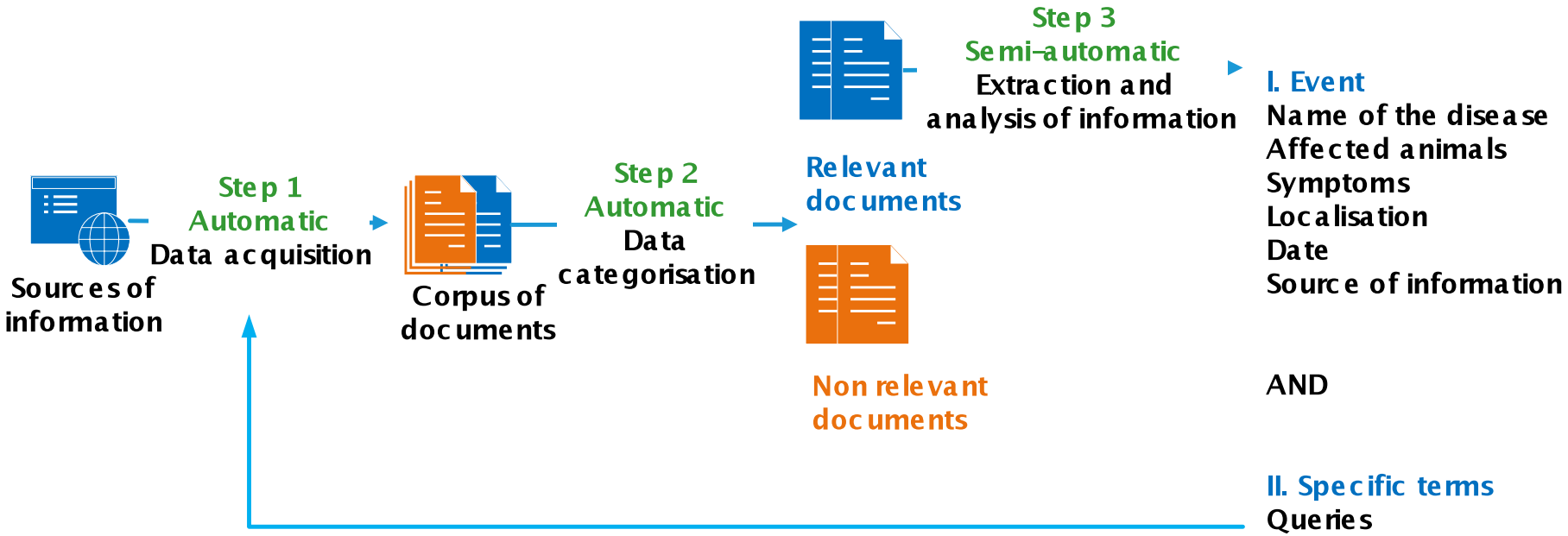




Classification algorithm		Naïve Bayes			Support Vector Machine		
Performance		Recall	Precision	F-score	Recall	Precision	F-score
Class	*disease*	0.724	0.766	0.744	0.657	0.68	0.669
	economy	0.478	0.530	0.503	0.489	0.726	0.584
	general	0.860	0.804	0.831	0.864	0.763	0.810
Weighted average		**0.750**	**0.745**	**0.747**	**0.732**	**0.729**	**0.725**

Methodology - *step 3*

- **Step 3: Information extraction and management**



Methodology - *step 3*

- **Step 3: Information extraction (I)**

Aim: Automatically detecting **key information** from **Web** news articles (country, species, diseases, number of cases, dates, …)

> "Since its initial appearance in **Poland** in **February 2014**, **72** cases of **African Swine Fever** have been detected in **wild boars** and there have been three outbreaks in **pigs**." - *http://www.thenews.pl*

- Use **dictionaries** (Geonames, HeidelTime, disease names, species names, etc.), and data mining techniques in order to learn extraction rules.

Rules assiociated with case numbers:
(number)(species_name,1-3) with support **26%** and confidence **83%**
(number)(species_name,1-2) with support **21%** and confidence **100%**

Methodology - *step 3*

- **Step 3: Information extraction (I)**

  - **First results for the rule-based approach on the annotated corpus**
  - **Classification based on SVM** (features are rules)
  - **3 classes:** correct, incorrect, partial
  - 10-fold cross validation

Type	Accuracy (%)
Locations	70.6
Dates	71.2
Diseases	93.6
Cases	78.1
Species	89.5

Julien Rabatel,
LIRMM, Numev, France

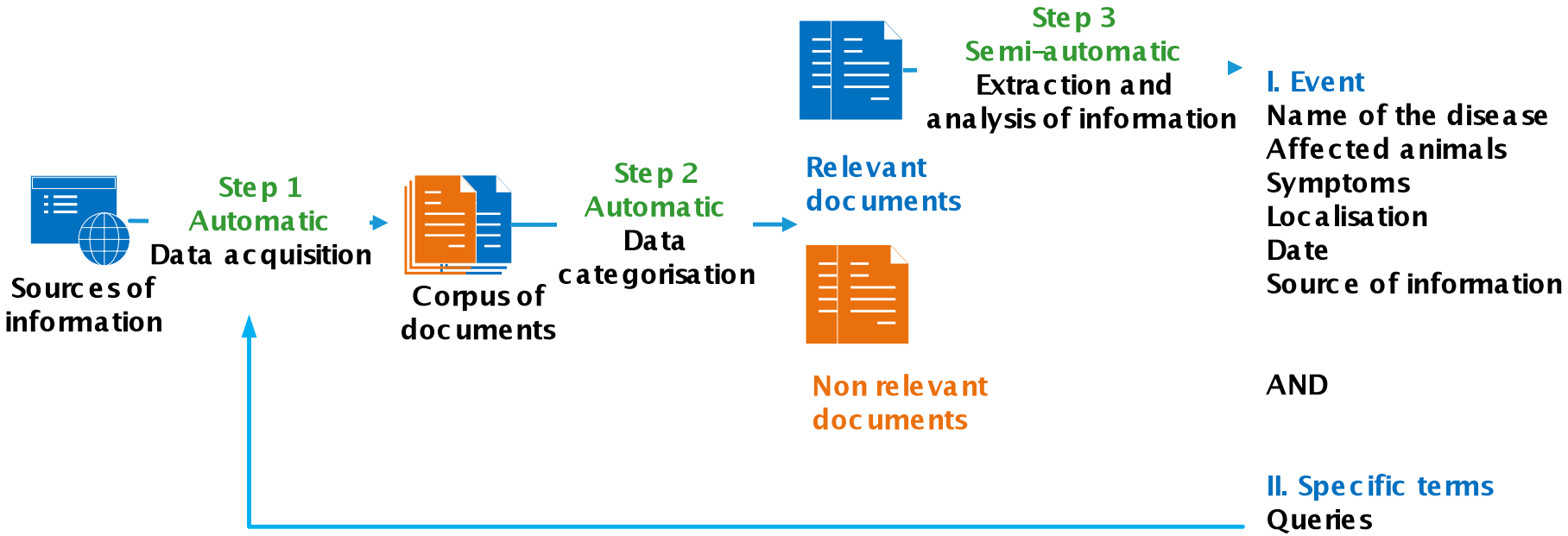
LABEX NUMEV

Methodology - *step 3*

- **Step 3: Information extraction (I)**

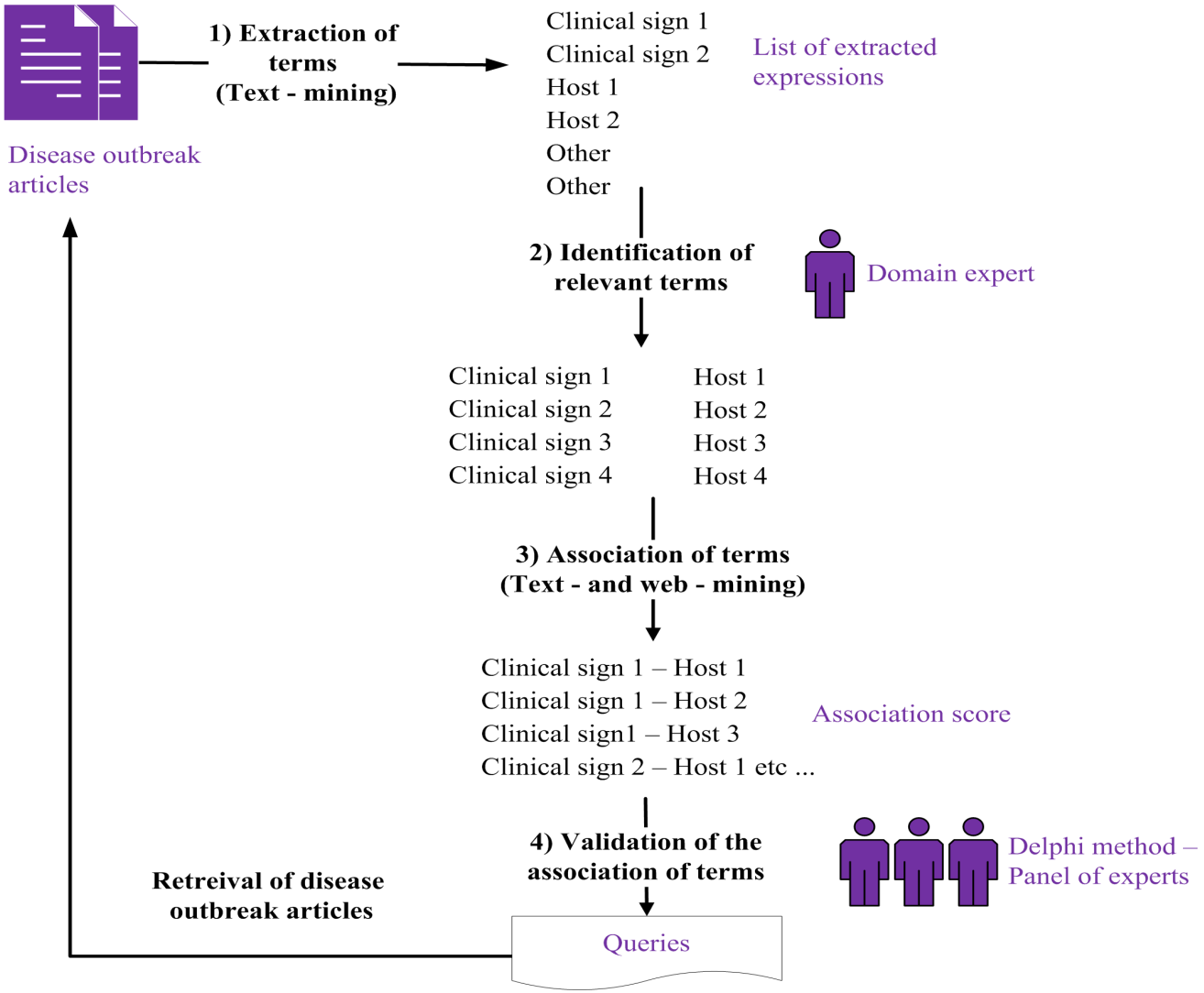
Methodology - *step 3*

- **Step 3: Information management (II)**



Methodology - *step 3*

- **II. Querying the Web**



Methodology - *step 3*

- **II. Querying the Web**: (a) ***Terminology extraction***

Methodology - *step 3*

- **II. Querying the Web**: (b) ***Terminology ranking***

Statistics

- Frequency (TF) → **important** word

$$TF_{i,j} = \frac{n_{i,j}}{\sum_k n_{k,j}}$$

- Inverse Document Frequency (IDF) → **discriminant** word according the distribution in the corpus

$$IDF_i = log \frac{|D|}{|d_j : t_i \in d_j|}$$

- Global value:

$$TF\text{-}IDF_{i,j} = TF_{i,j} \times IDF_i$$

Methodology - *step 3*

- **II. Querying the Web**: (b) ***Terminology ranking***

- BioTex Ranking [Lossio Ventura *et al.* IRJ'2016]:

$$LIDF\text{-}value(t) = \mathrm{P}(t_{dom}) \times IDF(t) \times C\text{-}value(t)$$

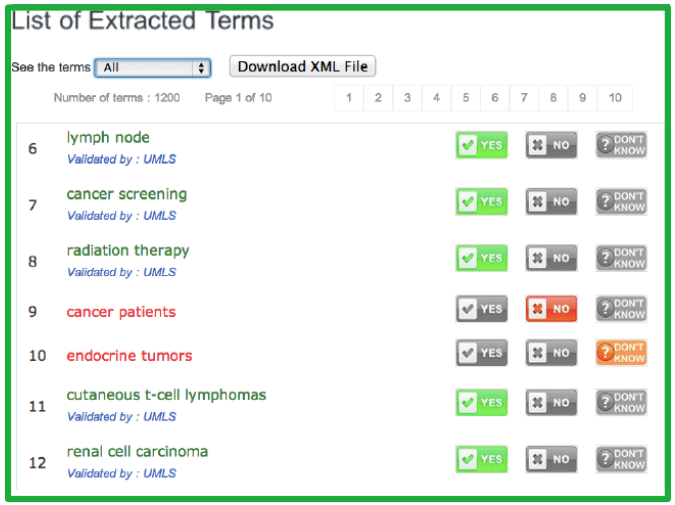
- A **new ranking function** to take into account the **heterogeneity** of the sources (S_i) [Arsevska *et al.* CEA'2016]:

$$w(t) = \sum \alpha_i \times \frac{1}{rank_{Si}(t)}$$

$$\text{with } \alpha_i \in [0,1] \text{ and } \sum \alpha_i = 1$$

Methodology - *step 3*

- **II. Querying the Web**: (c) ***Terminology validation***



Using of a **Delphi method** [Arsevska *et al.* LREC'2016].

*Delphi method is **to reach group consensus** with experts (5 to 7 experts for each disease) when knowledge is not sufficient for a given scientific question.*

Methodology - *step 3*

- **II. Querying the Web**: (c) ***Terminology validation***

List of **extracted terms** identified to characterize Bluetongue virus (BTV) emergence.

Clinical signs	**Term**
General	**livestock deaths**, **general clinical signs**, **onset of weakness**, excess mortality, **fever outbreak**
Reproductive	**embryonic death**, **reproductive disorders**, **occurrence of abortion**
Hosts	**Term**
	red deer, adult **sheep**, **cattle** herds, **roe deer**, cattle population, **newborn calves**, new born dairy calves, dairy calves, dairy ewes, **pregnant ewes**, cattle and **goats**, small ruminants

In bold are the terms proposed to experts for evaluation

Methodology - *step 3*

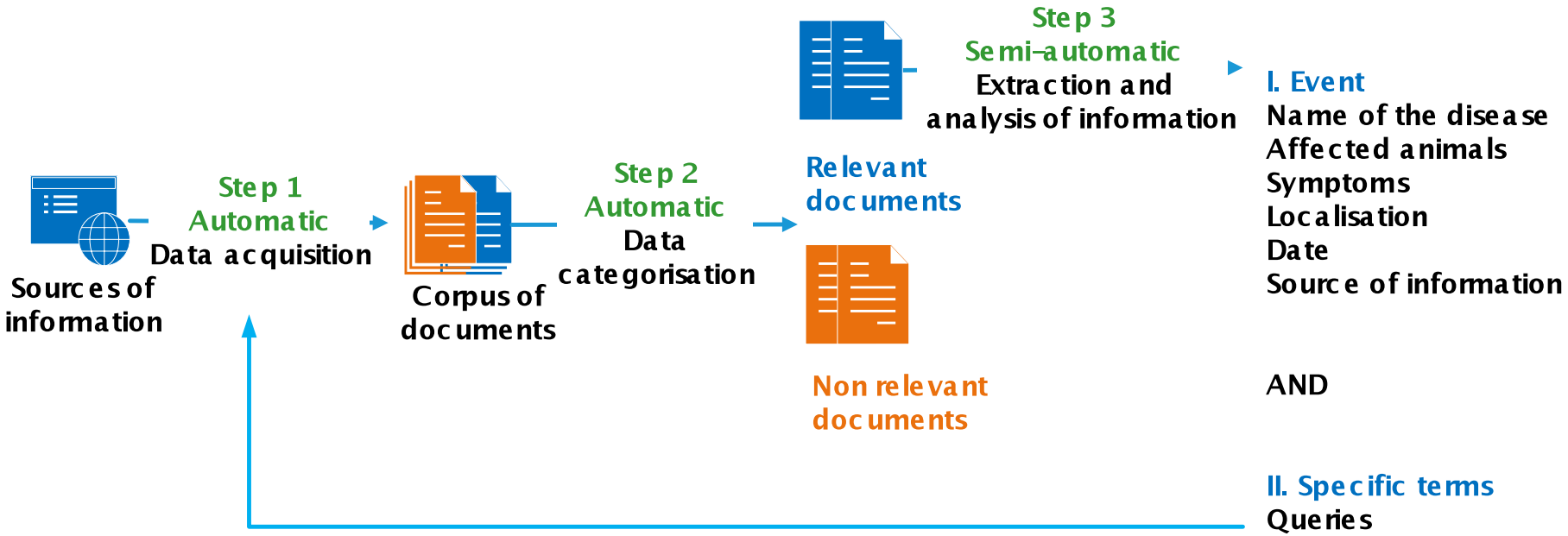
- **II. Querying the Web:** (d) ***Association of terms***

$$D^{AND}{}_{web} = \frac{2 \times hit(h \text{ AND } cs)}{hit(h) + hit(cs)}$$

[Roche and Prince Informatica'2010 ; Arsevska *et al. IJAEIS*'2016]

Rank	**Bluetongue** *hosts / clinical signs*	**Schmallenberg virus infection** *hosts/ clinical signs*
1	general clinical signs / pregnant ewes	stillborn bovine foetuses / camels
2	livestock deaths / sheep	stillborn bovine foetuses / bison
3	embryonic death / cow	aborted foetuses / sheep
4	general clinical signs / sheep	deformed offspring / sheep
5	livestock deaths / cow	stillborn bovine foetuses / deer
6	livestock deaths / deer	aborted foetuses / cattle
7	fever outbreak / sheep	deformed offspring / cattle
8	embryonic death / sheep	stillborn bovine foetuses / calves
9	fever outbreak / cow	deformed offspring / lambs
10	embryonic death / pregnant ewes	acute bronchopneumonia / bison

Methodology



Part 3

Applications in agricultural domain

Sentiment analysis

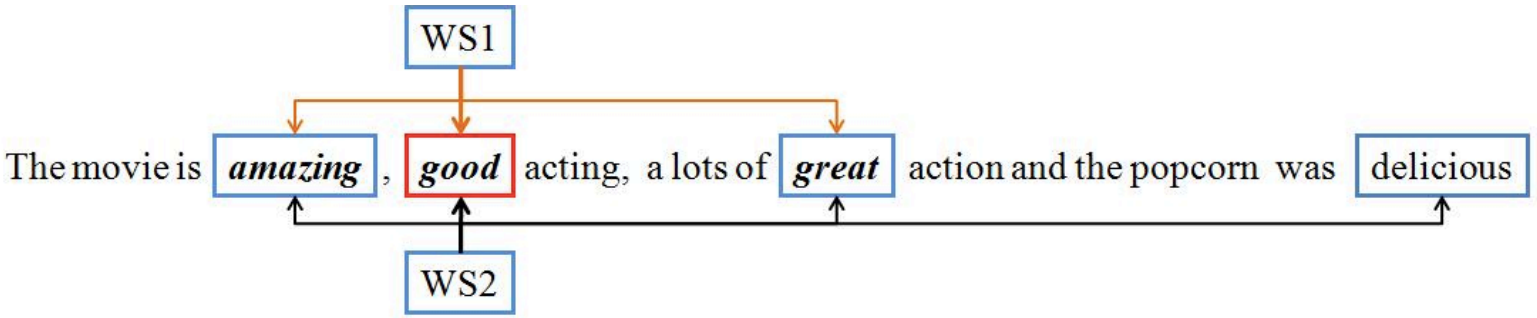
Sentiment analysis

Methods in order to identify sentiments:
Towards a sentiment lexicon

Step 1: choice of seeds related to opinions
P = {good; nice; excellent; positive; fortunate; correct; superior}
N = {bad; nasty; poor ; negative; unfortunate; wrong; inferior}

Construction of 14 corpora related to a specific domain

Step 2: PoS, Association rules, choice of a window



Sentiment analysis

Step 3: Statistic selection and web mining.

Statistic measures that consist of measuring the association between **seed adjectives** and **candidate adjectives** association based on "hits" from the web (i.e. search engine) and contextual information

Examples of learnt adjectives:
great, hilarious, funny, happy, perfect, important, beautiful, amazing, complete, major, helpful

→ Agriculture domain:
{gmo; agricultural biotechnology; biotechnology for agriculture}

Examples of learnt adjectives: *green, healthy, enthusiastic, creative, etc.*

Part 3

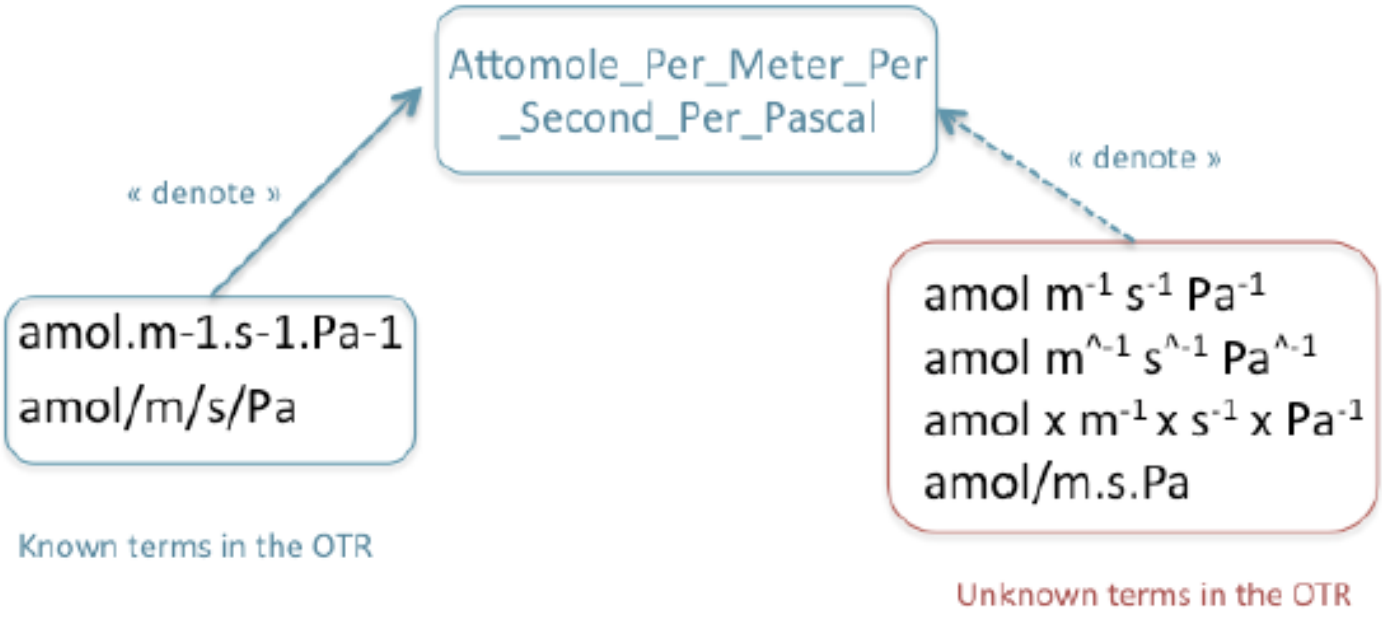
Applications in agricultural domain

Information Extraction from experimental data

Food science domain

Aim: Knowledge management in food science domain

Challenging issue: Unit recognition and extraction
[Berrahou *et al.* KDIR'2013 ; Berrahou *et al.* RNTI'2016]



Food science domain

Method:

- **Locating unit** (*machine learning*)
- **Extracting unit** (*lexical similarity*)

$$SM_{DL}(u1,u2) = max[0; \frac{\min(|u1|,|u2|) - DL(u1,u2)}{min(|u1|,|u2|)}]$$

$$\in [0;1]$$

Variant term	Reference	SMDc	SMDb
10e10 (cm3.m-1.sec-1.Pa-1)	10e10.cm3.m-1.sec-1.Pa-1	0.87	1
10e-14(cm3/m.s.Pa)	10e-14.cm3/(m.s.Pa)	0.89	1
10e-16cm3.cm/cm.cm2.s.Pa	(10e-16cm3.cm)/(cm2.s.Pa)	0.76	0.8
10e18 (mol.m/Pa.sec.m2)	10e18.mol.m/(Pa.sec.m2)	0.87	1
amol.m-1.s-1.Pa-1	amol.s-1.m-1.Pa-1	0.88	0.75
amol/m.s.Pa	amol/(m.s.Pa)	0.84	1
amol/m.sec.Pa	amol/(m.s.Pa)	0.69	0.75
cm3.um/m2.d.kPa	cm3.μm/(m2.d.kPa)	0.77	0.8

Part 4

Conclusions and future work

Conclusions

New challenges of *Big Data*:

- **Matching different types** of documents (image/text, video/text, and so forth)

- **Integration of visual analytics** skills [Fadloun, Inforsid'2016]